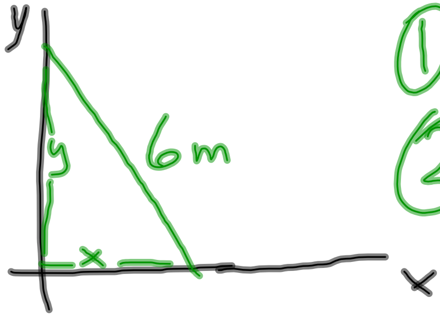


① Picture

② Create an eq^n that's ALWAYS true

$x^2+y^2=6^2$ "$(x(t))^2+(y(t))^2=36$"

$(x)^2$

$2x\frac{dx}{dt}$

$(y)^2$

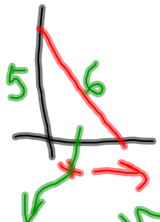
$2y\frac{dy}{dt}$

③ Differentiate w.r.t. t

$$2x\frac{dx}{dt}+2y\frac{dy}{dt}=0$$

④ Substitute in what I know

$$\cancel{2}x\frac{dx}{dt}+\cancel{2}y\frac{dy}{dt}=0$$



$\sqrt{36-25}=\sqrt{11}$

$$(\sqrt{11})\left(\frac{1}{2}\text{m/sec}\right)+(5\text{m})\frac{dy}{dt}=0$$

$$\frac{-\sqrt{11}}{2\cdot5}=\frac{dy}{dt}$$

$$\frac{dy}{dt}=\frac{-\sqrt{11}}{5\cdot2}\ \text{m/sec}$$

#1) Eqn: $y = 3x + 5$

a) given $\frac{dx}{dt} = 2$

find $\frac{dy}{dt}$ when $x = 1$

$$\frac{dy}{dt} = 3\frac{dx}{dt}$$

$$\frac{dy}{dt} = (3)(2) = 6$$

① Draw a picture
② Create an ALWAYS TRUE eqn.
③ Diff wrt 't'
④ substitute

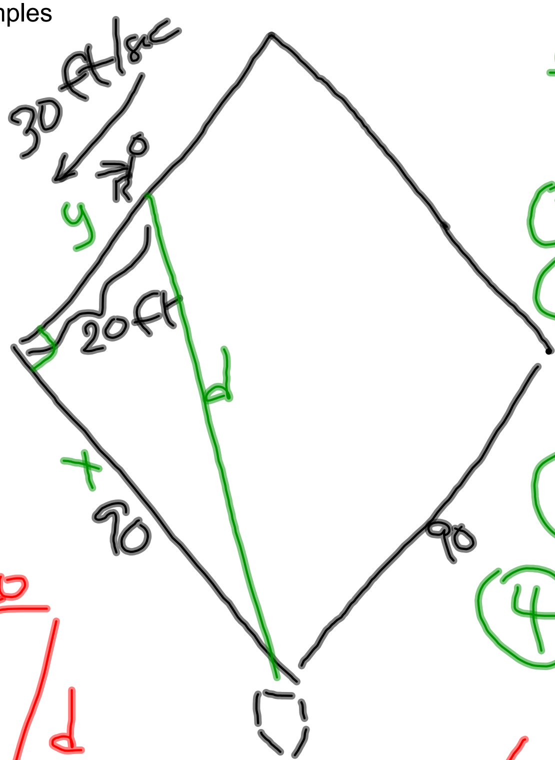
①② $y = 3x + 5$

③ $\frac{dy}{dt} = 3\frac{dx}{dt}$

b) $y = 3x + 5$
find $\frac{dx}{dt}$ given
$\frac{dy}{dt} = -1$ when $x = 0$

$$-1 = 3\frac{dx}{dt}$$

$$\frac{-1}{3} = \frac{dx}{dt}$$



find $\frac{dd}{dt}$

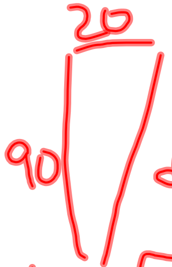
① ✓

② $x^2+y^2=d^2$

$90^2+y^2=d^2$

③ $0+2y\frac{dy}{dt}=2d\frac{dd}{dt}$

④ $y\frac{dy}{dt}=d\frac{dd}{dt}$



$d=\sqrt{90^2+20^2}$

$=10\sqrt{85}$

$(20)(-30)=(10\sqrt{85})\frac{dd}{dt}$

$\frac{-600}{10\sqrt{85}}=\frac{dd}{dt}$

$=-\frac{60}{\sqrt{85}}$

3.7/3 Eqn: $x^2+y^2=1$

(a) given $\frac{dx}{dt}=1$, find $\frac{dy}{dt}$ when $(x,y)=\left(\frac{1}{2},\frac{\sqrt{3}}{2}\right)$

① npr
② ✓
③ diff.
④ subs values

③ $x^2+y^2=1$

$2x\frac{dx}{dt}+2y\frac{dy}{dt}=0$

$\left(\frac{1}{2}\right)(1)+\left(\frac{\sqrt{3}}{2}\right)\frac{dy}{dt}=0$

$\frac{dy}{dt}=\frac{-1}{\sqrt{3}}$

Bruno Andrimanalimanana

37/4) $x^2+y^2=2x$

$(x,y)=(1,1)$; $\frac{dx}{dt}=-2$

$$x^2+y^2=2x$$

$$2x\frac{dx}{dt}+2y\frac{dy}{dt}=2\frac{dx}{dt}$$

$$(1)(-2)+(1)\frac{dy}{dt}=(-2)$$

$$-2+\frac{dy}{dt}=-2$$

$$\frac{d}{dx}(x)=1$$

$$\frac{dx}{dx}=1$$

$$\frac{dx}{dt}=1\left(\frac{dx}{dt}\right)$$

$\frac{dx}{dt} = \frac{1}{2}$ m/sec

when $y = 5$ m

what is $\frac{dy}{dt}$?

① draw a picture

② create an eqn that is always true

$$x^2 + y^2 = 6^2$$

③ differentiate w.r.t. t (time)

$$2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 0$$

$$x\frac{dx}{dt} + y\frac{dy}{dt} = 0$$

chain rule

$$\frac{d}{dt}\left(x(t)\right)^2$$

$$\frac{d}{dt} = 2\left(x(t)\right)\frac{dx}{dt}$$

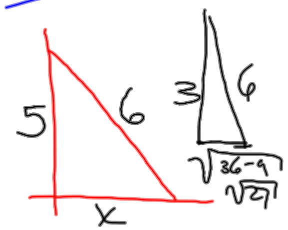
$$(y)^2 \Rightarrow 2(y)\frac{dy}{dt}$$

④ substitute values I am interested in

$$x\frac{dx}{dt} + y\frac{dy}{dt} = 0$$

$$(\sqrt{11})\left(\frac{1}{2}\right) + (5)\left(\frac{dy}{dt}\right) = 0$$

$\sqrt{27}$ $\quad$ 3

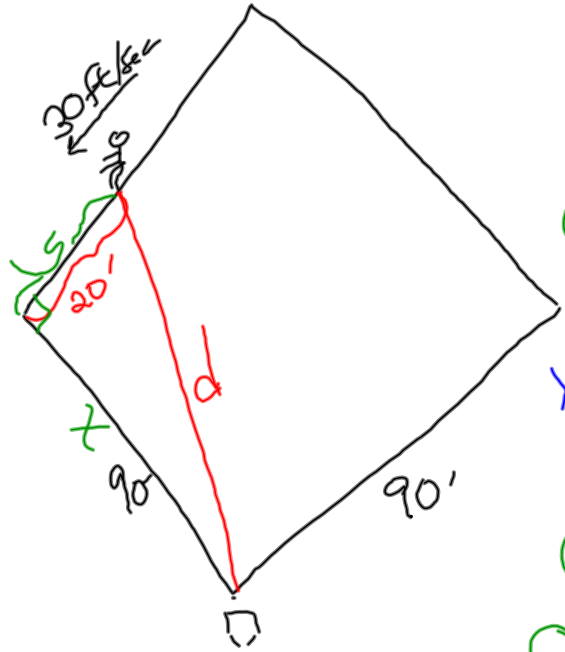


$$x = \sqrt{6^2 - 5^2}$$

$$= \sqrt{11}$$

$$\frac{dy}{dt} = \frac{-\sqrt{11}}{2 \cdot 5} = \frac{-\sqrt{11}}{10} \text{ m/sec}$$

$$\frac{dy}{dt} = -\frac{\sqrt{27}}{6} \text{ m/sec}$$



① create a picture ✓

② create an ALWAYS-TRUE eqn

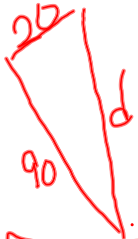
$$x^2+y^2=d^2$$

$$90^2+y^2=d^2$$

③ diff. wrt time

$$0+2y\frac{dy}{dt}=2d\frac{dd}{dt}$$

④ substitute for the "instantaneous" situation that interests me



$$d=\sqrt{20^2+90^2}$$

$$=10\sqrt{4+81}$$

$$=10\sqrt{85}$$

$$\sqrt{10^2(2^2+9^2)}$$

$$y\frac{dy}{dt}=d\frac{dd}{dt}$$

$$(20)(-30)=(10\sqrt{85})\frac{dd}{dt}$$

$$\frac{dd}{dt}=\frac{-600}{10\sqrt{85}}=\frac{-60}{\sqrt{85}}\ \text{ft/sec}$$

#4b $x^2+y^2=2x$

given $\frac{dy}{dt}=3$, find $\frac{dx}{dt}$ when

$$(x,y)=\left(2+\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}\right)$$

$$x^2+y^2=2x$$

$$\cancel{2}x\frac{dx}{dt}+\cancel{2}y\frac{dy}{dt}=\cancel{2}\frac{dx}{dt}$$

$$\left(2+\frac{\sqrt{2}}{2}\right)\frac{dx}{dt}+\left(\frac{\sqrt{2}}{2}\right)(3)=\frac{dx}{dt}$$

$$\left(\cancel{2}+\frac{\sqrt{2}}{2}-1\right)\frac{dx}{dt}=-\frac{3\sqrt{2}}{2}$$

$$\frac{2+\sqrt{2}-2}{2}\frac{dx}{dt}=-\frac{3\sqrt{2}}{2}\Rightarrow\frac{dx}{dt}=-\frac{3\sqrt{2}}{2}\left(\frac{2}{\sqrt{2}}\right)$$

$$=-3$$